

not discovered until too late to be corrected in the original publication.

The localities of the two species were reversed and the proper credit was not given for the discovery of *V. approxima*. The types of that species were not collected by Ferriss and Walker and did not come from Wilson's Cove. They were collected by Henry Hemphill many years before and were distributed by him as "*V. wheatleyi* Bld." As Hemphill's stay on Mt. Mitchell was very limited (See Proc. P. A. N. S. 1900, page 149) they were no doubt collected either along the trail to the summit or on Mt. Mitchell itself. Collectors who received specimens from Hemphill as *V. wheatleyi* would do well to reëxamine them carefully.

V. vanattai was collected by Walker in Wilson's Cove.

SUBSPECIES, MUTATIONS AND FORMS.

BY T. D. A. COCKERELL.

Messrs. Pilsbry and Ferriss in discussing the variations of *Bulimulus alternatus* (Proc. Acad. Nat. Sci. Phila., 1906, p. 140) say: "we can find no ground for dividing them [the different forms of subsp. *mariaë*] into several races, as Prof. Cockerell proposes."

It seems opportune to protest against this interpretation of my paper of 1891; the more so, since Prof. Pilsbry has before tried to insist upon the erroneous nature of my proposed classification. There is not, and never has been, the least divergence of opinion as to the actual facts. In 1891, of course, we did not know as much about the subject as we do to-day, thanks to the excellent researches of Messrs. Pilsbry and Ferriss; but now, as before, the objections to my nomenclature have no valid basis, except in a mere difference of opinion as to what should receive a name.

I grew up in England, accustomed to the methods of the Jeffreyian school, which paid little attention to slightly differentiated races, but bestowed names on all sporadic or individual variations which were striking enough to be easily recognized. Professor Pilsbry pays little attention to sporadic variations, but is very much interested in geographical races or subspecies. It was undoubtedly a

serious fault in the English work, that we were so little alert for racial characters, and we were also to blame for confusing under the name "variety" several different phenomena. I have watched the development of the American researches with admiration, and certainly have no fault to find with the methods adopted; but at the same time I believe we make a great mistake if we assume that sporadic varieties are not worth noting and recording. Professor Pilsbry will probably concede all this, in principle, but will object to giving them names. It is unavoidable, I suppose, that there should be differences of opinion about this; but it is certainly true that only when they are named and find a place in the manuals do they get properly noticed and recorded.

The best example of the English method which has so far appeared is found in Taylor's "Monograph of the Land and Freshwater Mollusca of the British Isles," now in course of publication. I can hardly believe that any naturalist can study this work without admiring its exhaustive treatment of variation, and perceiving the value, from the standpoint of evolution, of the orderly presentation of so great a mass of information. At the same time, it is not without its faults, one of which is the confusion together of different races and mutations, treating them all as "varieties," without discrimination. Thus under *Testacella scutulum*, the geographical form *major*, from Algeria, appears as a variety; while its mutation *albina* is made to include all pallid forms, whether from Algeria or elsewhere. It is evident that *albina* should be treated under *major* as a mutation; and the name *pallida*, proposed for the pale mutation of the typical *scutulum*, should be so applied. Following the Jeffreysian method, the term "monstrosity" is applied in an illogical manner to sinistral mutations and various distortions of the shell, which have nothing particular in common.

Deviations from the normal may be conveniently included under three heads:

1. *Subspecies*, as generally understood in this country; forms occupying a distinct territory (or it may be ecological position) of their own, but intergrading with the species.

2. *Mutations*, the so-called spontaneous variations, arising sporadically from some modification of the germ-plasm, and often persisting in limited strains. These include, among other things, sinistral and albino variations; and it is desirable that analogous variations of

different species should receive the same mutational name: *e. g.*, *sinistrorsum* for all sinistral mutations.

The interest attaching to these variations is very great at the present time, when so much is being said about the theories of de Vries and the Mendelian phenomena. We have, moreover, pretty good evidence that such "sports" have given rise to genuine specific characters, certain shells (*e. g.*, *Vitrea crystallina*) being permanently "albino," while whole genera have become sinistral. The sinistral mutations are perhaps of especial significance, inasmuch as in the nature of the case they must arise "all at once."

3. *Forms*, resulting from the immediate effect of the environment upon the individual, and presumably not inheritable in the proper sense of the word. I notice that Messrs. Pilsbry and Ferriss, in the work already cited (p. 169) name a "form" of *Goniobasis*.¹ These variations might be held to have the least significance of the three, but they are often striking, and are usually of interest from a physiological if not from an evolutionary standpoint. It must be remembered, also, that while they are said to be immediately due to the environment, this is only true in a partial sense; there must already exist the inheritable power of *responding in this particular way* to the conditions found. This power of response, as exhibited under diverse environments, is itself a thing of great interest to every biologist, and no one can doubt its significance in relation to the persistence and spread of species.

The term "variety" may well be retained for use in cases which cannot clearly be referred to one of the above categories. The simple trinomial may be used for the subspecies; in the case of the others, "var.," "mut." or "f." should be placed before the last name.

It should be added that not unfrequently "mutations" belong to particular races, which are distinguishable only from their power of producing them. Thus, I cannot see that the *Cochlicopa lubrica* of the Rocky Mountains and of England are in any wise different shells; but in England certain mutations are frequently produced, which are never seen in the Rocky Mountains.

¹ Omitting, however, to name the very distinct mutations, figs. 27 and 28, p. 167. According to the method I advocate, fig. 28 would be mut. *spiralis*, and the same name would be applied to similar mutations of other species, except when a different one had been earlier provided.